How Does Restoration Education Improve Student Attitude and Scores on Oregon Department of Education (ODE) Life Science Benchmarks?

Comparing 2009/2010 and 2010/2011 School Years.

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Abstract

After one year of teaching standard based classroom instruction on ODE Life Science benchmarks in 2009/2010, it was clear that student achievement was lower than I had strived for. My first year of teaching life science included eight weeks of lessons using our science textbooks, PowerPoint slides and notes and two ecological based field trips. My second year teaching life science in 2010/2011, included six weeks of hands-on native organism intensive lessons and two weeks of skill application and restoration projects on two different properties. I observed a significant increase in student attitude, homework completeness and test scores from 2009/2010 and 2010/2011 school years. I then developed a study to quantify how restoration education improves student attitude and scores on ODE life science benchmarks by comparing my first and second years teaching life science. My triangulation for this research included two years of comparative test scores, student work, and student interviews. In conclusion, restoration education improved student achievement and attitude.

Key words: restoration, ecology, benchmarks, scaffolding, community

Introduction

Rachel Carson wrote, "If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in" (Carson, 1956) My journey as an educator begun with deciding to become a companion for children. To listen to their stories, to provide experiences they will cherish forever, to show them the complex and beautiful world of plants and animals, and to share my own true love and respect for nature. This quote has been an inspiration to bring back the sense of wonder back to children's lives and to inspire them to be stewards of the land, as I once was taught by my loving and caring grandmother in Northern Wisconsin.

The two years I have spent collecting data on children's understanding of life science have been the most rewarding years of my life. I have watched over 250 children become re-born in their sense of wonder and I have nurtured them each step of their journey. In an ideal world, the restoration projects that we completed should be integrated into core subjects so that children can build on concepts in all content areas. The goal of this action research project was to show how restoration education can improve student attitude towards school, improve test scores and improve overall quality and mastery of written assignments.

Literature Review

Research has linked an improvement of standardized test scores to student exposed to environmental and outdoor education programs. In 2006 and 2009, articles published by Bartosh, Tudor, Ferguson and Taylor compared test scores between middle school students who had an emphasis on "systematic environmental education program" and student that did not. Both

studies showed that student scores increased when environmental and outdoor education were the focus of their education.

In another article written by Deborah Simmon in 1998, *Using Natural Settings for Environmental Education: Perceived Benefits and Barriers*, she emphasized the benefits of outdoor education and that kids need to be outside and that it is good for their mental and physical health. She focused on the concepts that a natural setting improves student grades, social skills and overall appreciation of school.

In the book "*Last Child in the Woods",* Richard Louv describes the effects of nature deficit disorder on children in the United States. He studied how modern children spend over 8 hours in front of a "screen" per day and as a result of this, have little to no experiences or understanding of the outside world. Children with "nature deficit disorder" tend to be hyperactive, obsessed with technology, poor eaters, have a lower vocabulary for their age and have lower reading skills. It is this book that inspired me to take this class through The Earth Partnership for Schools because I too noticed this trend in my students. On my first day of teaching my ecology unit both years, I started by asking students to draw and describe a grasshopper. More than 60% of the students could not do this. My students in Albany, Oregon are suffering from this disorder and it is my mission to pull kids from the computer, television and video game screen and show them the beauty and majesty of nature.

Background

Calapooia Middle School (CMS) is located in Albany, Oregon. There are currently 765, 6-8th grade students. Situated in a low-income housing neighborhood, CMS is a Title 1 school with 67% of the students receiving free or reduced lunch. It is the extreme poverty, lack of travel

and outdoor experiences that led me to incorporate restoration education into my curriculum because students had little to no background in nature and ecology.

I was not impressed with student achievement and attitude during my first year teaching life science at CMS during 2009/2010. Students were lazy, unmotivated, and indifferent to our learning goals and objectives. This year, I decided to integrate more opportunities for students to engage in their learning by doing many field trips, outdoor journaling, guest speakers, restoration of two properties and an intensive focus on native organisms in our community.

Students in low income schools generally have little to no background of the natural world around them. They rarely go on vacation to "nature" and parents are generally uneducated about ecology, plant names, and animal names so they don't teach their kids ecological relationships at home. Teachers are ultimately responsible for providing experiences and providing scaffolding to help students build connections. By providing students with real-world connections to ecological relationships and their own community they are able to establish a better understanding of the relationships between organisms in their environment. I am a teacher that is well connected in the community, has access to grant money, is fluent in local native flora and fauna, and is fearless in terms of bringing their students on field trips and outdoors. I am the only teacher in my school district that has integrated these alternative learning environments. It is my goal to relay to my peers and school district that restoration education improves student achievement and it should be integrated into all grade levels and be supported by administrators and district level employees. In 2011 I will submit my research paper as an article in our district newsletter, presenting to the School Board, presenting to staff members in my own building, and presenting my research at an Earth Partnership for Schools community meeting at the Institute

for Applied Ecology in the Summer of 2011 and offer a professional development workshop during in-service week for the 2011/2012 school year.

There is no environmental curriculum in place in our school district aside from the standard "Ecology Benchmarks" required by the State of Oregon. The Benchmarks do not require community outreach, hands-on learning, problem based learning, or cooperative learning. There is no requirement about learning native organisms and no requirement that students learn by experimental design or through community action.

When I started teaching ecology last year, I had no access to "nature". My school yard is grass and non-native trees and shrubs. I wanted to provide a richer environment for students to learn ecology but didn't have the resources to do it. To solve this problem the following year, I partnered with local environmental organizations and wrote grants to do two large restoration projects with my students in the spring of 2011.

Before becoming a science teacher, I was a field biologist and an environmental educator for a local wildlife center for four years. I taught middle school age students about ecology and habitat on a 10 acre property and engaged students through hand-on experiences and place-based learning. I realized that students were attentive, ready to learn, and eager to master concepts when brought outside and given real plants and animals to work with. When I became a life science teacher, I wanted to integrate those outdoor experiences in to my classroom. I quickly realized how difficult it was to get students outside because of time, money for field trips, teacher/administrator support, and access to native habitat. I desperately want to continue to try to bring my students outdoors and it is my goal with this research paper, to show teachers and administrators in my district how important outdoor learning experiences are and how student

learning increases as a result of place-based learning and hands-on learning opportunities when paired with ecology benchmarks

Habitat and ecological restoration projects integrate core subject areas and integrate mastery of skills while making science meaningful. The goal of this action research project was to examine their mastery of ecological concepts and skills as well as to study other learning that took place during two separate restoration projects.

Teachers are ultimately responsible for providing this education on ecology. By providing students will real-world connections to food chains and food webs, they are able to establish better understanding of the relationships between organisms in their environment. A teacher that is well connected in the community, has access to grant money, is fluent in local native flora and fauna, and is fearless in terms of bringing their students on field trips is key. Very few teachers in my school district do fieldtrips and project based learning associated with ecology.

After teaching standard based classroom instruction on general ecology benchmarks, how does adding two ecological restoration projects improve students overall understanding and attitude toward ecology? I wanted to measure how student learning increased after being given the opportunity to do work in an ecosystem and do work for an ecosystem.

Problem Statement

There were 172 students that were in 2009/2010 6th grade class. There were 132 students that were in 2010/2011 6th grade class. There was a range of 15-20 talented and gifted students per year and about half of the students each year were below grade level in reading, writing and math skills. Within these two groups, there were students that did not master concepts regardless

of my efforts and teaching. The schedule at our school allows a daily 38 minute period for re-teaching to students that did not master the targets the first time. Student attitude was very negative last year with a low homework turn in rate and low State test scores. Therefore, the research question for this project was: how does restoration education improve student attitude and scores on ODE life science benchmarks when comparing 2009/2010 and 2010/2011 school years. As a result of this I found that the data was significant and the restoration education was a success. It is my hope that more outdoor education will be integrated in all subject areas.

Methodology

To measure the improvement in student attitude, quality of work and State test scores, a four learning target system was developed:

> Learning Target 1: FOOD CHAINS and FOOD WEBS. This means I can write a food chain correctly. I can label the producer, 1st level consumer and 2nd level consumer in a food chain. I can also define and give an example of a decomposer, herbivore, carnivore and scavenger out of an energy pyramid. I can identify that 3rd level consumers are "obligate" carnivores and only eat other animals. I can define, draw and identify a food web. I can explain that all organisms are part of a food web and that it is more complicated than a food chain. I can use a food web to predict changes in populations.
>
> Learning Target 2: ENERGY PYRAMID. I can explain that almost all the energy on Earth comes from the sun. I can explain that about 10% of the energy an organism gets is stored in its cells and tissues and about 90% of the energy is used

by the organism or given off as heat. I can use energy pyramids as a model to predict how many organisms can be at any part of a food chain.

Learning Target 3: POPULATION. I can define and give an example of an organism and a population. I can explain how changes in populations are related to resources such as food, water, shelter, and space. I can draw a population graph. I can predict something that would make a population go down. I can predict something that will make a population go up. *I am exceeding benchmark if I can define, draw, and give an example of limiting factors and carrying capacity.*

Learning Target 4: ADAPTATION: I can define an adaptation. I can give three examples of adaptations and how they are useful to the organism.

There were 172 students that were in 2009/2010 6th grade class. This group did not have a focused restoration curriculum. General ecology of Oregon was the focus and native organisms and relationships were emphasized.

2009/2010 Qualitative Study Group Activities:

1. Thirty students were picked randomly and asked questions regarding attitude towards school, homework motivation and favorite class subjects.
2. Student science journals were reviewed for each activity, field trip and project and analyzed based on the four above learning targets.
3. Students went on a field trip through a program called “Salmon Watch” that focuses on salmon populations, migration, ecological niches, and conservation issues.

4. Students went on was a one and a half hour field trip where the entire 6th grade class planted over 900 native trees on a nearby property owned by Janet and Ed Rust. The Greenbelt Land Trust (GLT) has a conservation easement on the property and has nicknamed it "The Little Willamette" for its residual stream channel oxbow that once was a vital spawning ground for endangered coastal salmon species and currently endangered Western pond turtles. CMS students developed a partnership with the GLT this year and will monitor and continue restoration efforts as long as teachers maintain interest and motivation to participate in the partnership.
5. Students were involved in an Oregon Department of Fish and Wildlife (ODFW) program called "Eggs to Fry". Students raised native Chinook salmon in tanks in the classroom and released them into the nearby Willamette River.
6. Students practiced learning targets by viewing PowerPoint presentations and taking notes.
7. They used their Holt Science and Technology Life Science textbooks for reading and knowledge based learning.
8. Students did small projects focused on local food chains and food webs and studied salmon and spotted owls as case studies.

2009/2010 Quantitative Study Group Activities:

Quantitative data was analyzed using ODE Life Science test scores that both study groups completed at the end of each school year. ODE uses terminology to rate student achievement on the basis of "*exceeding, meeting or not meeting benchmark*". For this research project, students *meeting* benchmark were considered to have mastered the four learning targets.

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2010/2011 Qualitative Study Group Activities:

1. Thirty students were picked randomly and asked questions regarding attitude towards school, homework motivation and favorite class subjects.
2. Student science journals were reviewed from each activity and project and analyzed based on the four above learning targets.
3. Students went on a field trip through a program called "Salmon Watch" that focuses on salmon populations, migration, ecological niches, and conservation issues.
4. Students went on was a one and a half hour field trip where the entire 6th grade class planted over 450 native trees The Little Willamette managed by GLT.
5. Students went on one three and a half hour field trip to observe and record Herpetile populations and how to improve and implement habitat for the endangered Western pond turtle.
6. Students completed photo point monitoring at The Little Willamette to learn about phenology and how ecosystems change of time.
7. Students partnered with The Institute for Applied Ecology and participated in their RESTORE program. RESTORE partners teach students and teachers how to implement and restore their schoolyard to its original condition. Students researched and drew native plant landscape designs and competed for their design to be implemented.

8. Students were involved in an Oregon Department of Fish and Wildlife (ODFW) program called “Eggs to Fry”. Students raised native Chinook salmon in tanks in the classroom and released them into the nearby Willamette River.
9. Students practiced learning targets by viewing PowerPoint presentations and taking notes.
10. They used their Holt Science and Technology Life Science textbooks for reading and knowledge based learning.
11. Students did small projects focused on local food chains and food webs and studied salmon and spotted owls as case studies.
12. Students were visited and taught ecology curriculum outdoors by a local environmental organization called “Avery House”. Students learned about food chains, food webs and energy pyramids by playing games with native plants and animal artifacts outdoors.
13. Students grew and studied over 40 native plants in their class room grow lab. Labs were focused on form and function of the plant in its habitat. Students drew and learned key identification skills. Students learned to use field guides to identify and describe their plants.

2010/2011 Quantitative Study Group Activities:

Quantitative data was analyzed using ODE Life Science test scores that both study groups completed at the end of each school year. ODE uses terminology to rate student achievement on the basis of “*exceeding, meeting or not meeting benchmark*”. For this research project, students *meeting* benchmark were considered to have mastered the four learning targets.

Results

Thirty students from 2009/2010 and thirty students from 2010/2011 were interviewed and observed during the ecology unit, see Appendix A. Homework data was analyzed over the two year period and compared. My qualitative results were expected but still astonishing. Student attitude about school improved from year to year. During 2009/2010, 69% of students said science was their favorite class because they got to move around, work with their hands, draw, and learn about plants and animals. They also really like physical education because they got to go outside. During 2010/2011 school year, 92% of the students said that science was their favorite subject, primarily because they got to go outside. It is my prediction that once students started to go outside on classes other than physical education, science became their favorite class. Attendance for both years on field trips was always 100%. Generally students during the 2009 and 2010 study year were whiny, complained about homework, socialized in class, and had an overall high degree of apathy towards science class. Overall, only 60% of all homework assignments were turned in during the ecology unit of the 2009/2010 school year.

During 2010/2011 school year, students were eager to work on assignments; there were no complaints about homework and students reminded others around them to be quiet and to stay on task; see Appendix A. Apathy disappeared early in the school year in our classroom. Students advocated for themselves and respected each other and their teacher every day. Overall, 81% of homework was turned in during the ecology unit for the 2010/2011 school year. It is my belief that homework rate increases with a “reason” to do it and a more reasonable design like collecting plants or writing nature observations as homework instead of worksheets and reading assignments. Students liked not having to do writing and reading for all science assignments like

they had to do in all other classes. 85% of students said they were more likely to do their homework if it involved "doing something" rather than reading or writing only.

Student ecology vocabulary increased from 2009/2010 and 2010/2011 school years. In 2009/2010, students could use general ecology vocabulary related to general organisms and often could not list native organisms by their full name in their science journals, in class warm ups and in class discussions. In 2010/2011, students were able to integrate advanced ecology vocabulary in all assignments completed and were able to discuss and write about community aspects, habitat restoration and stewardship of the land. Students from 2010/2011 year were able to integrate all of their vocabulary into conversation and writing and were comfortable describing and identifying native organism's full names.

During the restoration project of 2009/2010, students planted a variety of native shrubs and trees (Appendix E) at the Little Willamette property. The Albany Democrat-Herald cam to document the planting and the students were overjoyed and so proud of them selves. All but 2 of the trees survived and the students did an excellent job planting the trees to ensure their survival.

During the restoration projects of 2010/2011, the students had all good feedback to apply to this research project. The in-class lessons from our guest speakers from Avery House, Institute for Applied Ecology, Greenbelt Land Trust, City of Albany, and Integrated Resource Management were informative and students were on task ready to learn. The Calapooia restoration projected title "RESTORE" was funded with a $500.00 grant from our Parent/Teacher Club and hundreds of dollars worth of seed from Integrated Resource Management. The field trips were all funded by the City of Albany and the Institute also got grants to purchase some of the plants planted on our school yard.

Action Plan

While conducting this action research project, I found that the most exciting part was connecting with my students and watching them succeed in exactly the way I hoped. Watching my students plant native plants, identify critical components of habitat, and justify their work to other students and community members was the most satisfying thing I have ever done. I knew that incorporating the outdoors and making learning meaningful was the way I was supposed to be teaching science but my results were so outstanding that I felt relieved that all of my efforts were for good reason. The future is very exciting. I have built strong relationships with local environmental organizations, city employees, small business owners and grantees. I plan to continue to bring students outside to do meaningful projects despite school district budget cuts, increased class size and the exhausting effort it takes to pull off an effecting restoration project with 11 and 12 year olds.

I plan to increase awareness that the outdoors are useable by all subject areas by presenting to staff and school board in May 2011. It is my hope that these presentations will inspire my peers to support me and other teachers willing to do things differently and non-traditionally. Our school district embraces and is implementing Professional Learning Communities (PLC) within all buildings. These PLC's create strong relationships within subject area teams and it is my hope to expand collaboration between all PLC teams to encourage project-based learning. I hope that "Environmental Stewardship" will become an "Essential Outcome" of our school goals and objectives and that all teachers embrace stewardship as a way to make learning meaningful to students. ODE has written environmental benchmarks for each grade level for students in our State. It is my goal to improve the use of those benchmarks to show the school board that these benchmarks should be mandated in the same way reading, writing and mathematics are.

Finally, I will start applying for grants this summer to ensure that I will have funding to continue the restoration projects at Calapooia and The Little Willamette. I will be sure to plan ahead and build restoration into my curriculum every year for the rest of my career.

Develop and maintain partnerships

Final reflection

This practice has not benefitted my teaching. In fact, it was exhausting and I knew the results were significant without documenting it. I would much rather just give a presentation than write a paper because I have so much grading to do and work for other parts of my life that the paper and all of the details are overwhelming me. I think the concept of action research is valuable and important I just don't think I need to go through all of this each time I want to prove a point.

What went well during this process is finding out that I could compare State tests scores from last year to this year. I didn't think those scores were saved from last year and on a whim, I asked my principal. I am glad I chose to look into it because it made my research project more satisfying and convincing.

Last year when I taught life science, I really felt like I did a good job and my students were working at the best of their ability. When I noticed the 20% achievement gap between years, I was shocked mainly because I didn't attribute it to my teaching skills to change in classroom lessons. I attributed it to a better group of kids. The kids this year are so sweet and very bright and kind. Last years students were exhausting and I struggled every day to keep them motivated. The students may appear to be "better" this year because of the restoration projects because nearly all of them enjoy science the best out of all of their classes.

Next year I will continue my work on incorporating restoration education into my curriculum. Unfortunately I just heard that I will be teaching 8th grade Earth Science and so focusing on plants and animals won't be possible next year. I am going to need to use water quality, soil pits, erosion, and the water cycle as my restoration hook. Maybe I will build a rain garden or help restore a local stream channel to help filter pollutants. I need to always refocus my ideas to what is relevant for the students and the class subject. I really hope to partner with the math department next year and do some restoration collaboratively with different age groups and skill level all on the same project.

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Appendix A

Student Interviews 2009/2010 School Year

1. What is your favorite class at Calapooia Middle School? Sample answers: science, P.E., industrial technology, home economics (all hands on classes)
2. What was your favorite project that you did in science during 6th grade? Sample Answers: Planting trees, cell model, growing plants
3. Why do you like going outside in science class? Sample Answers: get to move, getting wet and muddy, something different, no sitting, usually we are just learning, not doing work
4. Why is homework easier to complete in science class than in other classes? Sample Answers: it is more fun because it is my favorite class, Mrs. Mellenthin is nice and I want her to like me, we don't have a lot so I do it when we do
5. What does ecology mean? Sample Answers: animals living together in the same area, animals that live in the same place
6. What is ecosystem restoration? Sample Answers: When land is hurt we make it better by planting trees, take out the pollution and plant trees, make the world better from people destroying it for farms and cities
7. What is a native organism? Sample Answers: something here, lives in Oregon, only in Oregon
8. What is a community partner? Sample Answers: don't know, a friend that helps you with homework, Mrs. Mellenthin's friends, scientists that come to our class and help us do fun things.

9. Why is it important to restore habitat? Sample Answers: because animals need food, water, shelter and space, habitat is what they need to live, no habitat means no animals
10. What organisms benefit when land is restored? Sample Answers: All animals benefit and plants too, the plants get the most, then the herbivores and then carnivores, plants are the best to restore because all things need them
11. Did you meet benchmark for ecology in 6th grade? If so, why do you think you did so well? Sample Answers: 61% yes 39% no
12. What did you like best about our ecology unit this year? Sample Answers: Mrs. Mellenthin is the best teacher, she makes science fun, she lets us go outside and learn science, we get to move around and talk a lot in class, salmon watch and the Oregon garden was super fun.
13. What do you think I could do differently next year? Sample Answers: More field trips to fish hatchery and OMSI, to see how our plants are growing at the other property we planed them on, Oregon Coast Aquarium, sit with our friends, do more CPS remotes, have the principal come to class and fieldtrips more
14. Do you think I should do restoration projects with my students next year? Why or why not? Sample Answers: Yes because I always think of my tree that I planted and I want to see it again. I know other kids will want that to see their plants if they plant them. Calapooia is ugly and you should make it pretty by planting a forest and flowers here. Restoration is cool because you meet people and you get to go outside and you get to get dirty and not sit. Yes, more restoration next year for sure

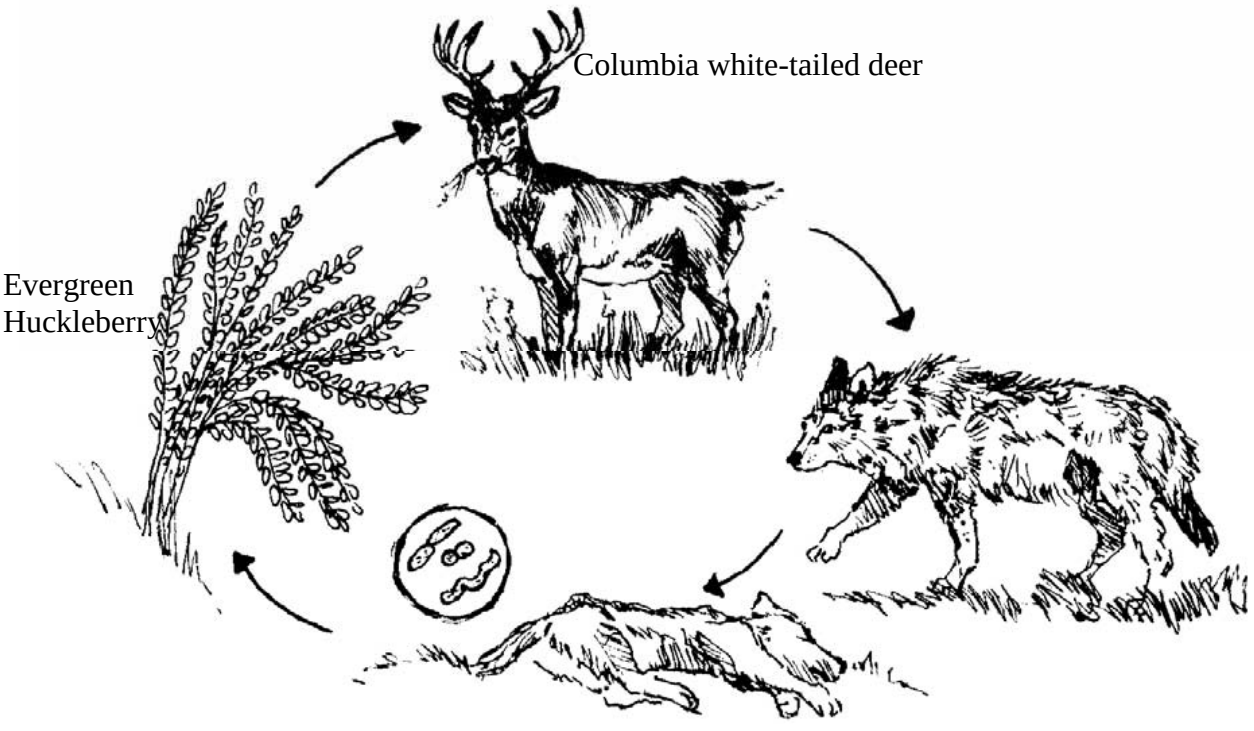
Student Interviews 2010/2011 School Year

1. What is your favorite class at Calapooia Middle School? Sample answers: science, P.E., industrial technology, home economics (all hands on classes)
2. What was your favorite project that you did in science during 6th grade? Sample Answers: Planting trees, RESTORE, What is your favorite color native insect lab, Photo point field trip, reptiles and amphibians field trip, salmon watch field trip, fish release field trip
3. Why do you like going outside in science class? Sample Answers: Because we learn better out there, the classroom is distracting. I can be by myself and get my work done. No one bothers me. The bad kids are nice outside and we all do the something and it is not annoying. I like the rain and sun so being outside is good for me. It makes it easier to go to school for the rest of the day because I wake up.
4. Why is homework easier to complete in science class than in other classes? Sample Answers: Mrs. Mellenthin makes homework fun by having us collect things from nature as our homework. Instead of reading and writing we get pinecones, grass, feathers, bugs or other stuff and have to bring it in and tell the class how it is part of the ecosystem and what would happen if it was gone. I like it because we have to think really hard but not do work. Mrs. Mellenthin doesn't make homework work a lot of points.
5. Are you more likely to do your homework if there is something to do, rather than just to read or write something? For example, if your teacher asked you to collect at least 5 different types of vegetables from your home, or if your teacher asked you to write a story about your favorite foods; which assignment would you choose? Why? Sample Answers: I like doing something other than writing or reading. When I do something for homework that I can bring in to my class, it is more fun. When there isn't paper to do, I like the

work better because it is different. I always have math homework and I get sick of all of the work. Science homework is fun because I always get to collect something or draw a plant or animal I see. It is not hard to look around or learn science even if you don't read or write for homework.
6. What does ecology mean? Sample Answers: Relationships with plants and animals. Living things living together in a place like a habitat. Plants being the most important and all others need them to live. Food water shelter and space all there to make living easier for plants and animals.
7. What is ecosystem restoration? Sample Answers: When land is ruined by people we need to fix it by using science and planting plants that should be there from long ago.
8. What is a native organism? Sample Answers: A camas, a checkermallow, and sword fern. Valley pine or something from here and only here. It is here because it is supposed to. It grew up here and it is natural.
9. What is a community partner? Sample Answers: Some one who helps you plant you garden or the forest. The help Mrs. Mellenthin buy things like plants and buses. They are scientists who teach us things to help us with our projects.
10. Why is it important to restore habitat? Sample Answers: Everything needs a place to live and it is destroyed we need to clean it up. Now that we know what to do, we can do more to help restore land. Maybe more land should be saved in Albany?
11. What organisms benefit when land is restored? Sample Answers" Everything benefits because all factors like water, soil, plants, animals, food, shelter and space are all good and there is enough for everyone.
12. Did you meet benchmark for ecology in 6th grade? If so, why do you think you did so well? Sample Answers" See Appendix D
13. What did you like best about our ecology unit this year? Sample Answers. Salmon Watch, field trips, making a garden, going outside, learning in groups, being able to move around and talk during class, not always having homework that was hard.
14. What do you think I could do differently next year? Sample Answers: 61% meeting in 2009/2010 78% meeting in 2010/2011
15. Do you think I should do restoration projects with my students next year? Why or why not? Sample Answers: Yes because they need to take care of our habitat that we made. They need to plant more gardens like we did. We need more land restored at the Little Willamette because it might die if Calapooia doesn't come back there every year. All kids should do it because it is really fun and school would not be so fun if we didn't have Mrs. Mellenthin or our projects. It made school possible.

Appendix B

Sample OAKS Test for 6th Grade Life Science Benchmarks for 2009/2010 and 2010/2011



Maggot

Coyote

In the above picture, which picture represents a decomposer?

a. Columbia white-tailed deer
b. Coyote
c. Evergreen huckleberry
d. Maggot
e. None of the above

In the above picture, which picture represents a producer?

a. Columbia white-tailed deer
b. Coyote
c. Evergreen huckleberry
d. Maggot
e. None of the above

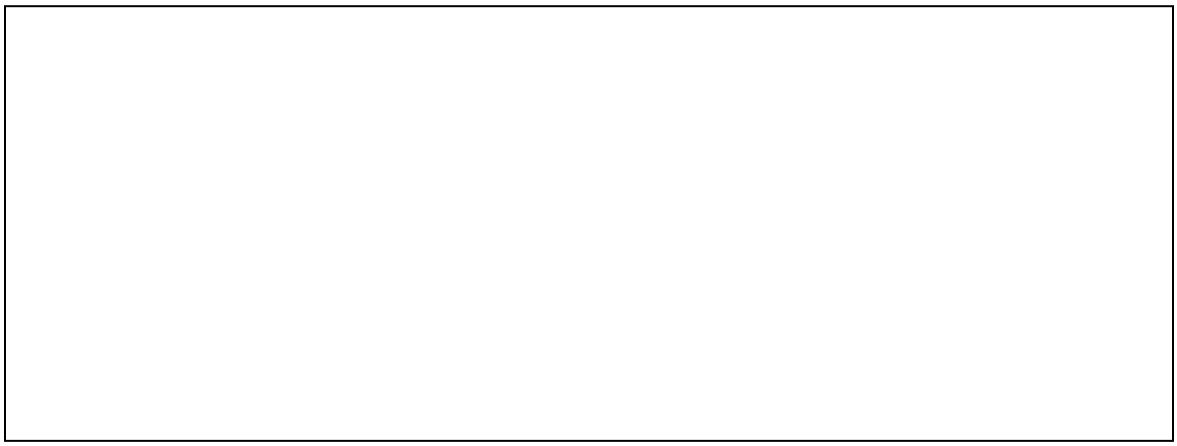
An example of a predator-prey relationship would be
A. Oak tree - water.
B. Chinook salmon-river
C. Ref-tailed hawk – Deer mouse.
D. Nelson's Checkermallow-Riparian habitat
E. Both B and C

If all green plants died, would cougars survive?
A. Yes, cougars do not eat green plants.
B. Yes, cougars could still eat other animals.
C. No, the animals that cougars eat need to eat green plants.
D. No, they would have no more plants to eat.

Animals have adaptations that help them survive. One example of this is the salmon's gills. What primary purpose does this adaptation serve?
A. Protection from heat
B. Gathering of food
C. Absorbing oxygen
D. Increased speed

Draw a food chain using the following list of clues:

Maggots	Bumble bee	Camas lily	Turkey Vulture
Coopers hawk	Maggots	American Robin	Sun



What do the arrows ⟶ represent in the food chain you just drew?

_____

What is a "native species"?

_____

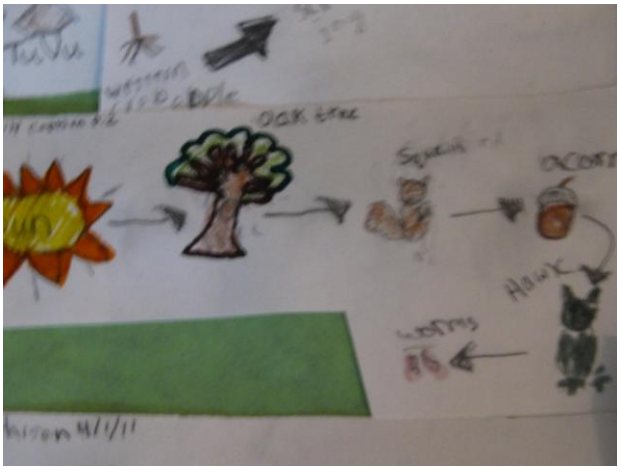
List 1 plant species that is native to the Willamette Valley, Oregon._____.

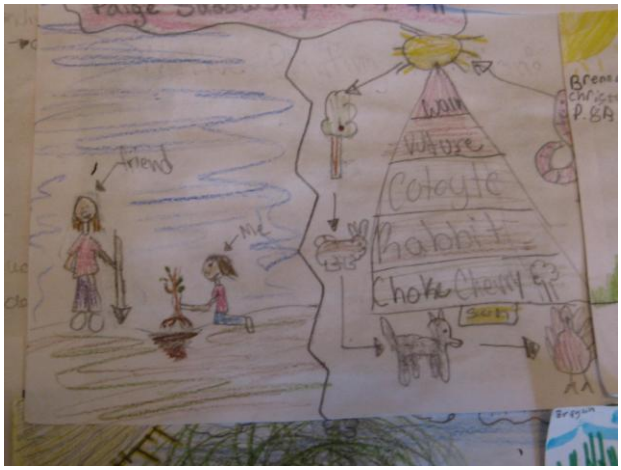
List 1 animal species that is native to the Willamette Valley, Oregon._____.

Appendix C

Comparing Student Work Samples

Target 1 and 2; 2009/2010. Draw a food chain and energy pyramid and show amount of energy available at each level using native organisms.

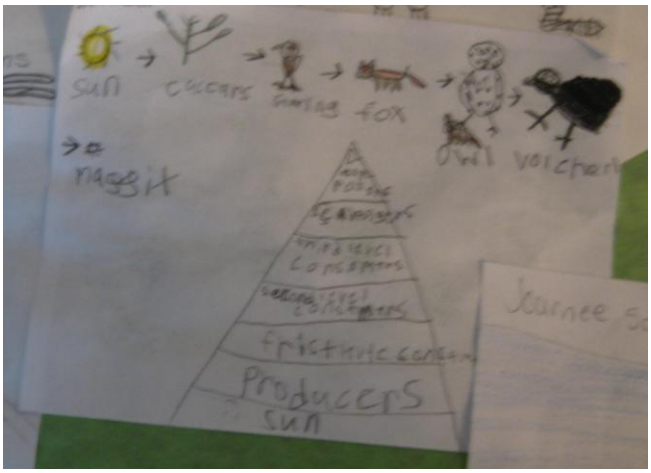




Student 1A **Student 1B**

Student 1C: "Plants are everywhere and hawks are not... There are more plants than other animals. The sun is at the top and so is the vulture and worm."

<u>Target 1 and 2; 2010/2011.</u> Draw a food chain and energy pyramid and show amount of energy available at each level using native organisms.



Student 2A **Student 2B**

Student 2C: "There are more cascaras (native hardwood tree) than 3rd level consumers and scavengers…Not all living things eat each other…A little energy moves from each level…"

Target 3: 2009/2010. Define organism, population and community by using them in sentences. Name plants and animals.

Student 1D: "Organisms are salmon and lots of salmon live in a river. Lots of salmon is a population. Community is when salmon and insects and plants live in the same place."

Target 3: 2010/2011

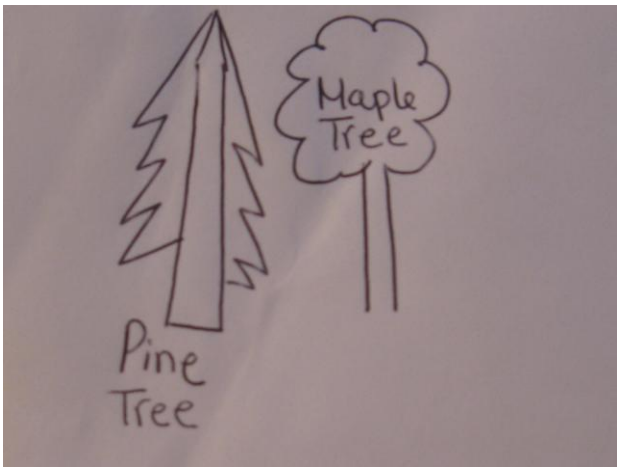
Define organism, population and community by using them in sentences. Name plants and animals.

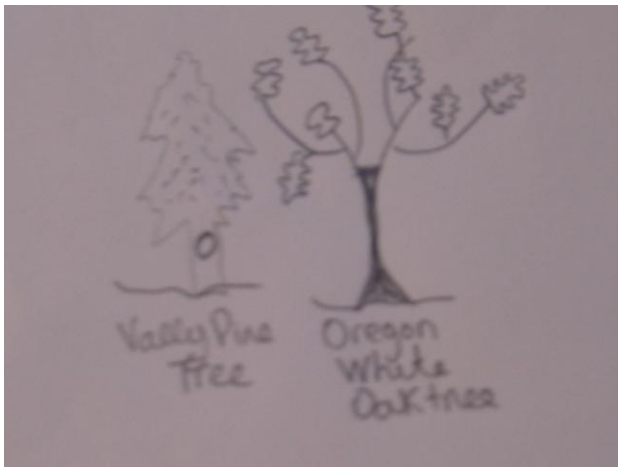
Student 2D:

"Camas populations are small now compared to long time ago. Butterflies eat the food that the camas organisms make. Butterflies and camas make a community."

Target 3: 2009/2010 **Target 3: 2010/2011**

Take 1 min to draw two different "food sources" for birds and mammals.





Student 1E **Student 2E**

General Ecology Understanding; Draw and label 'good' habitat.

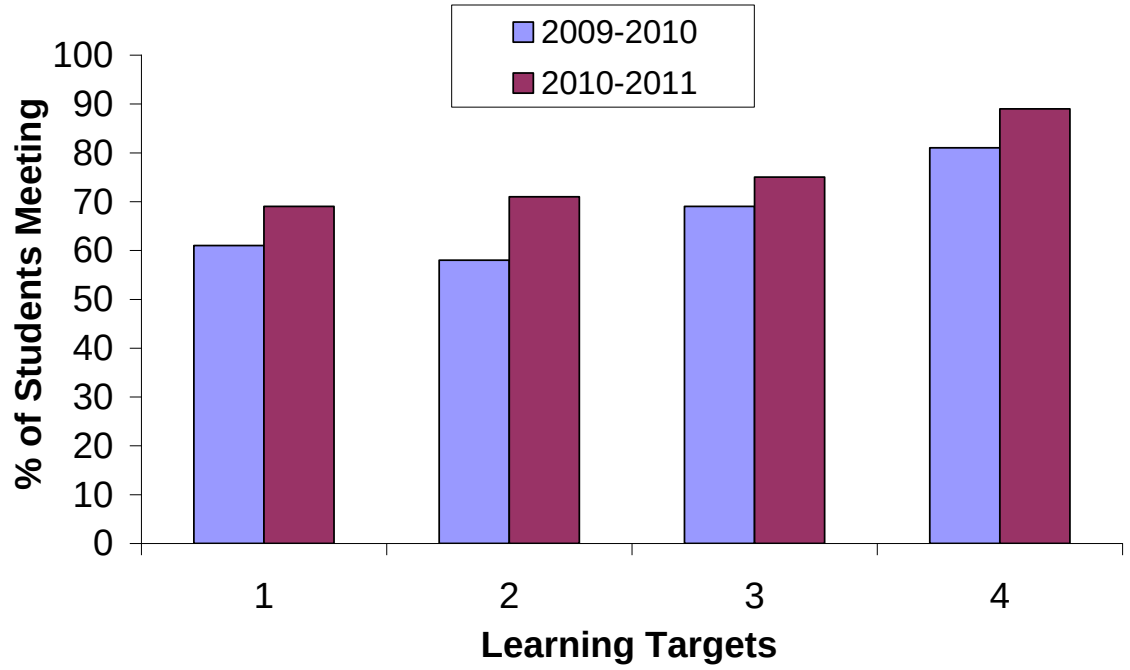
2009/2010 **2010/2011**

Student 1F

Student 2F

Appendix D

OAKS Test Score Comparison between 2009/2010 and 2010/2011 School Years.


2009-2010
2010-2011
% of Students Meeting
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
Learning Targets

Appendix E

Native plants grown and used for restoration for 2009/2010 and 2010/2011 school years.

Number planted	Scientific Name	Common Name	Planting Location	Year Planted
50	*Alnus rhombifolia*	White Alder	Little Willamette	2009/2010 and 2010/2011
75	*Crataegus douglasii*	Oregon Hawthorn	Little Willamette	2009/2010 and 2010/2011
100	*Fraxinus latifolia*	Oregon Ash	Little Willamette	2009/2010 and 2010/2011
50	*Pinus ponderosa*	Valley Pine	Little Willamette	2009/2010 and 2010/2011
64	*Prunus virginiana*	Common Chokecherry	Little Willamette	2009/2010 and 2010/2011
50	*Populus trichocarpa*	Black Cottonwood	Little Willamette	2009/2010 and 2010/2011
25	*Pyrus fusca*	Western Crabapple	Little Willamette	2009/2010 and 2010/2011
100	*Quercus garryana*	Oregon White Oak	Little Willamette	2009/2010 and 2010/2011
25	*Rhamnus purshiana*	Cascara	Little Willamette	2009/2010 and 2010/2011
50	*Spiraea douglasii*	Western Spirea	Little Willamette	2009/2010 and 2010/2011
25 and 5	*Symphoricarpos albus*	Common Snowberry	Little Willamette and Calapooia Middle School Courtyard	2010/2011
50and 2	*Crataegus douglasii (big)*	Oregon Hawthorn	Little Willamette and Calapooia Middle School Courtyard	2010/2011
25 and 25	*Sidalcea nelsoniana*	Nelson's Checkermallow	Little Willamette and Calapooia Middle School Courtyard	2010/2011
100 and 40	*Camassia quamash*	Cama's lily	Little Willamette and Calapooia Middle School Courtyard	2010/2011
2	*Acer circinatum*	Vine maple	Calapooia Middle School Courtyard	2010/2011
4	*Rubus spectabilis*	Salomon berry	Calapooia Middle School Courtyard	2010/2011
4	*Rubus parviflorus*	Thimble berry	Calapooia Middle School Courtyard	2010/2011
5	*Rosa nutkana*	Nootka rose	Calapooia Middle School Courtyard	2010/2011
10	*Polystichum munitum*	Sword fern	Calapooia Middle School Courtyard	2010/2011
10	*Vaccinium ovatum*	Evergreen huckleberry	Calapooia Middle School Courtyard	2010/2011
50	*Fragaria oregana*	Oregon strawberry	Calapooia Middle School Courtyard	2010/2011
20	*Saxifraga oregana*	Saxifrage	Calapooia Middle School Courtyard	2010/2011
50	*Prunela vulgaris*	Heal-all	Calapooia Middle School Courtyard	2010/2011
1000	*Deschampsia cespitosa*	Tufted hair grass	Calapooia Middle School Courtyard	2010/2011
1000	*Hordeum brachyantherum*	Meadow barley	Calapooia Middle School Courtyard	2010/2011
1000	*Eriophyllum lanatum*	Oregon sunshine	Calapooia Middle School Courtyard	2010/2011
1000	*Sisyrinchium montanum*	Blue-eyed grass	Calapooia Middle School Courtyard	2010/2011
1000	*Festuca idahoensis*	Romers fescue	Calapooia Middle School Courtyard	2010/2011
1000	*Elymus glaucus*	Blue wild rye	Calapooia Middle School Courtyard	2010/2011
1000	*Gilia capitata*	Gilia	Calapooia Middle School Courtyard	2010/2011
5	*Mahonia aquifolium*	Red flowering currant	Calapooia Middle School Courtyard	2010/2011
40	*Dicentra formosa*	Pacific bleeding heart	Calapooia Middle School Courtyard	2010/2011
10	*Trillium petiolatum*	Trillium	Calapooia Middle School Courtyard	2010/2011
5	*Mahonia aquifolium*	Oregon grape	Calapooia Middle School Courtyard	2010/2011
10	*Gaultheria shallon*	Salal	Calapooia Middle School Courtyard	2010/2011